

# CHEMICAL FERTILIZER AS A POTENTIAL SOURCE OF PERCHLORATE

*Prepared for*

Lockheed Martin Corp.

Burbank, California

*Prepared by*

TRC

Irvine, California

November 1998

## TABLE OF CONTENTS

|   | <u>PAGE NO.</u> |
|---|-----------------|
| LIST OF TABLES  | ii              |
| 1.0 INTRODUCTION  | 1               |
| 2.0. HISTORIC OCCURRENCE OF PERCHLORATE IN FERTILIZER MATERIALS | 1               |
| 3.0 ANALYSIS OF MODERN FERTILIZERS                              | 2               |
| 4.0 SUMMARY   | 2               |
| 5.0 REFERENCES  | 3               |
| TABLES  |                 |

TABLE OF CONTENTS  
(Continued)

LIST OF TABLES

TABLE NO.

TITLE

1

Summary of Perchlorate Analyses for Various Chemical Fertilizers

# CHEMICAL FERTILIZER AS A POTENTIAL SOURCE OF PERCHLORATE

## 1.0 INTRODUCTION

1. Lockheed Martin Corporation (LMC) discovered in the course of ground water quality investigations in southern California that relatively low (i.e., on the order of 10  $\mu\text{g/L}$ ) concentrations of perchlorate occurred in ground water that was unlikely to have been impacted by known probable sources. To investigate these occurrences of perchlorate, LMC enlisted the support of TRC. This report summarizes TRC's findings regarding other potential sources of perchlorate. Review of available literature and testing of selected samples of chemical fertilizer indicate that chemical fertilizers contain perchlorate.

## 2.0 HISTORIC OCCURRENCE OF PERCHLORATE IN FERTILIZER MATERIALS

1. The presence of naturally-occurring perchlorate was measured in sodium and potassium nitrate mined from caliche deposits in Chile (i.e., in Chilean saltpeter). Chilean saltpeter is used as a nitrate fertilizer throughout the world. Schilt (1979) describes reports of perchlorate in Chilean saltpeter as far back as 1896, with concentrations ranging from trace to 6.79 percent. The broad range in perchlorate concentrations observed is attributed to recycling of liquid used in the production process for the nitrate salts and the possible non-uniform distribution of naturally occurring perchlorate. Levels of perchlorate of 1 to 1.5 percent in refined and crude Chilean saltpeter, respectively, measured in 1914 were also described (Schilt, 1979). A study in 1972 attributed stunted soybean growth to elevated concentrations of perchlorate (i.e., assumed to be percent level) in Chilean nitrate fertilizer. Finally, the occurrence of perchlorate in several water supply wells in Long Island, New York was recently reported in a discussion paper presented for the Interagency Perchlorate Steering Committee stakeholders forum (IPSC, 1998). The observed distribution pattern of perchlorate in this case was speculated to have resulted from low levels of perchlorate in fertilizer imported from Chile.

### 3.0 ANALYSIS OF MODERN FERTILIZERS

1. The above historical information strongly suggests that modern fertilizers containing Chilean saltpeter contain perchlorate. Therefore, a sample of commercially-available potassium nitrate fertilizer from the Chilean Nitrate Company was obtained and analyzed for perchlorate along with seven other commercial fertilizers that were selected more or less at random. The solid fertilizers were dissolved in water and analyzed using ion chromatography. The results of these chemical analyses are presented in Table 1. As shown, five of the eight fertilizers tested had perchlorate concentrations above the detection limit, and the detected concentrations range from 0.55 to 2.7 percent.
2. It is important to note that with the exception of the Chilean Nitrate Company sample, the source of the nitrate in the fertilizers is not well characterized. In addition, the sample of SUL-PO-MAG, which consists of potassium magnesium sulfate, is a material typically derived directly from the mineral langbeinite, which is not related to Chilean nitrate. The SUL-PO-MAG contained 1.5 percent perchlorate.

### 4.0 SUMMARY

1. Analysis of available literature and testing results indicates the following:
  - Historically, Chilean saltpeter (sodium and potassium nitrate) contained naturally occurring perchlorate in concentrations of trace to approximately 7 percent.
  - Recent analysis of commercial fertilizers indicates perchlorate concentrations ranging from trace to 2.7 percent. However, the variability among specific products and manufacturers is not clear.
  - It is likely that there are sources of perchlorate in fertilizer other than Chilean nitrate (i.e., langbeinite and possibly manufacturing processes) since some fertilizers tested did not contain this substance.
2. These preliminary results are not conclusive and further work would be necessary to confirm that chemical fertilizer is a source of perchlorate. Such additional work could include further sampling of fertilizer raw materials (i.e., Chilean saltpeter and langbeinite), and research into chemical fertilizer manufacturing processes to identify the source of perchlorate.

## 5.0 REFERENCES

Schilt, Alfred, 1979. "Perchloric Acid and Perchlorates, Fredrick Smith Chemical Company," 1979.

CDFA, 1997. "California Department of Food & Agriculture, Agricultural Chemical Usage Records," 1997.

IPSC, 1998. Interagency Perchlorate Steering Committee Stakeholders' Forum Discussion Paper, August 25 and 27, 1998: *"Perchlorate Contamination in the Environment."*

**TABLE 1****SUMMARY OF PERCHLORATE ANALYSES  
FOR VARIOUS CHEMICAL FERTILIZERS**

| BRAND/<br>DESCRIPTION                          | MANUFACTURER                                      | NITRATE SOURCE  | RESULT <sup>(1)</sup> |         |
|--|---|---|-----------------------|---------|
|  |   |   | ppm                   | %       |
| Champion<br>Potassium Nitrate<br>13.5/0/45(2)  | Chilean Nitrate Corp.<br>Norfolk, Virginia        | Chilean<br>Sodium/Potassium<br>Nitrate                            | 7,500                 | 0.75    |
| K-Power<br>Potassium Nitrate<br>13.5/0/46      | Vicksberg Chemical Co.<br>Vicksburg, Mississippi  | Potassium Nitrate<br>Domestic U.S.<br>Primarily Domestic Products | 27,000                | 2.7     |
| Grow More<br>6/30/30                           | Grow More Corp.<br>Gardena, California            | Varies by Price<br>Domestic and/or Import                         | < 4,000               | < 0.4   |
| Best All Purpose<br>Triple Sixteen<br>16/16/16 | J.R. Simplot<br>Lathrop, California               | Varies by Price<br>Domestic and/or Import                         | 18,000                | 1.8     |
| SUL-PO-MAG<br>0/0/22                           | Bandini Fertilizer Co.<br>Los Angeles, California | Not Applicable <sup>(3)</sup>                                     | 15,000                | 1.5     |
| Bandini (Professional)<br>16/8/8               | Bandini Fertilizer Co.<br>Los Angeles, California | Varies by Price<br>Domestic and/or Import                         | <4                    | <0.0004 |
| Best Performance<br>Lawn and Turf<br>12/12/12  | J.R. Simplot<br>Lathrop, California               | Varies by Price<br>Domestic and/or Import                         | <4                    | <0.0004 |
| Vigoro Growth<br>12/12/30                      | Bandini Fertilizer Co.<br>Los Angeles, California | Varies by Price<br>Domestic and/or Import                         | 5,500                 | 0.55    |

98-120/Tbls&amp;FigsDisk2 (9/29/98/cy)

- (1) Results are based on a single sampling event, and should be considered as information only, unless a more statistically-based sampling and analysis program is conducted.
- (2) Nitrogen/Phosphorus/Potassium content in percent.

- (3) Sample does not contain nitrates. The mineral ingredients are purchased on a commodity basis from both import and domestic sources, based on price.